

# Machine Learning

Programme course

6 credits

Maskininlärning

TDDE01

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Computer Science  
and Media Technology

**Date determined**

2017-01-25

## Main field of study

Information Technology, Computer Science and Engineering, Computer Science

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Computer Science, Master's Programme
- Computer Science and Engineering, M Sc in Engineering
- Information Technology, M Sc in Engineering
- Computer Science and Software Engineering, M Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Probability theory; Statistics; Mathematical analysis; Linear Algebra; Basic programming.

## Intended learning outcomes

The overall aim of the course is to provide an introduction to machine learning, with special focus on regression and classification problems. Machine learning is presented from a probabilistic perspective with inference and prediction based on probability models. The course aims to give students an overview of machine learning within a unified framework and a good basis for further studies in the field.

After completing the course the student should be able to:

- use relevant concepts and methods in machine learning to formulate, structure and solve practical problems.
- infer the parameters in a number of common machine learning models.
- use machine learning models for prediction and decision making.
- evaluate and choose among models.
- implement machine learning models and algorithms in a programming language.

## Course content

Introduction and overview of machine learning and its applications. Unsupervised and supervised learning. Discriminative and generative models. Prediction. Generalization. Classification. Nearest neighbors. Naïve Bayes. Discriminant analysis. Cross-validation. Model selection. Overfitting. Bootstrap. Regression. Regularization. Ridge regression. Lasso. Variable Selection. Binary and multi-class regression. Dimension reduction. PCA. ICA. Kernel smoothers. Support Vector Machines. Decision trees. Gaussian processes. Mixture models.

## Teaching and working methods

The course consists of lectures and computer laboratory work. The lectures introduce concepts and theories that students then use in problem solving at the computer labs.

## Examination

LAB1	Laboratory work	3 credits	U, G
DAT1	Computer examination	3 credits	U, 3, 4, 5

DAT1 is an exam in a computer hall that tests students' theoretical knowledge and problem-solving skills in machine learning. UPG1 consists of computer exercises that tests the students' ability to translate theoretical knowledge into practical problem solving in machine learning.

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Department

Institutionen för datavetenskap

## Director of Studies or equivalent

Ann-Charlotte Hallberg

## Examiner

Oleg Sysoev

## Education components

Preliminary scheduled hours: 48 h

Recommended self-study hours: 112 h

## Course literature

### Additional literature

#### Books

Bishop, C. M, (2006) *Pattern Recognition and Machine Learning* Springer  
Hastie, T., Tibshirani, R., och Friedman J., (2009) *The Elements of Statistical Learning: Data Mining, Inference and Prediction 2:a upplagan* Springer

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).